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APPLICATION NUMBER: ***60/422,348***
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PTO/SB/16 (10-01)
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV 045459984 US

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Yonatan Ezra	Silver Darshan	Jerusalem, Israel Nofei Aviv, Beit Shemesh, Israel

☐ *Additional inventors are being named on the____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

INTERACTIVE TELEVISION SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☐ Customer Number _____ → *Place Customer Number Bar Code Label here*

OR *Type Customer Number here*

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification and Drawings *Number of Pages* 36
☐ Drawing(s) *Number of Sheets*
☒ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☐ Other (specify)

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.
☒ A check or money order is enclosed to cover the filing fees
☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number 23-0920
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($) $160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.
☐ Yes, the name of the U.S Government agency and the Government contract number are. _____

Respectfully submitted,

SIGNATURE _____ Date 30 Oct. 2002

TYPED or PRINTED NAME L. Friedman REGISTRATION NO. *(if appropriate)* 37,135

TELEPHONE 312-655-1500 Docket Number: 7251/88725

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C.

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☒ Check ☐ Credit card ☐ Money ☐ Other ☐ None

☐ Deposit Account

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Deposit Account Name: WELSH & KATZ, LTD.

The Commissioner is authorized to: *(check all that apply)*

☐ Charge fee(s) indicated below ☒ Credit any overpayments

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☐ Charge fee(s) indicated below, except for the filing fee to the above identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	160.00
				SUBTOTAL (1)	$160.00

2. EXTRA CLAIM FEES FOR UTILITY AND

	Extra Claims		Fee from below	Fee Paid
Total Claims	-20** =	0	X	= 0.00
Independent Claims	- 3** =	0	X	= 0.00
Multiple Dependent				=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent
				SUBTOTAL (2) $0.00

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FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non - English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR § 1 17(q)	
126	180	126	180	Submission of Information Disclosure Statement	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	740	246	370	Filing a submission after final rejection (37 CFR § 1 129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1 129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid SUBTOTAL (3)

SUBMITTED BY				Complete *(if applicable)*	
Name (Print/Type)	L. Friedman	*Registration No (Attorney/Agent)*	37,135	*Telephone*	312-655-1500
Signature				*Date*	30 October 2002

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I hereby certify that this Provisional Patent Application is being deposited with the United States Postal Service "Express Mail" Post Office Service under 37 CFR 1.10 on the date indicated above and addressed to: Box PROVISIONAL APPLICATION, Commissioner for Patents, Washington, D.C. 20231. This Patent Application includes a Provisional Patent Application Transmittal Form, a Fee Transmittal for FY 2001 (in duplicate), Application Data Sheet (2 pages), a Specification, Claims and Drawing (36 pages), check in the amount of $160.00 for filing. The person mailing this Provisional Patent Application is:

Daryl Jones
Typed or Printed Name of Person Mailing Paper of Fee

Daryl B. Jones
Signature of Person Mailing Paper or Fee

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Application Data Sheet

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Application Information

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Representative Information

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Registration Number Four::	27,429
Registration Number Five::	25,060
Registration Number Six::	22,053
Registration Number Seven::	27,466
Registration Number Eight::	29,434
Registration Number Nine::	29,054
Registration Number Ten::	29,381
Registration Number Eleven::	34,044
Registration Number Twelve::	27,600
Registration Number Thirteen::	34,137
Registration Number Fourteen:	38,110
Registration Number Fifteen::	39,724
Registration Number Sixteen:	39,021
Registration Number Seventeen:	37,963
Registration Number Eighteen:	37,135
Registration Number Nineteen:	40,604
Registration Number Twenty:	37,435
Registration Number Twenty-One:	45,195
Registration Number Twenty-Two:	40,687
Registration Number Twenty Three:	41,050

Assignee Information

Assignee Name: NDS Limited

Assignee Address: One London Road
Staines, Middlesex TW18 4EX
United Kingdom

PATENT
7251/88725

anticit.doc P-107 YS/MY/DZ 28OCT02/2

Title: Interactive Television System

1. FIELD OF THE INVENTION

The present invention relates to interactive systems such as, for example, interactive television systems.

2. BACKGROUND

The following are believed to represent the relevant state of the art:

1. Albatrossdesign.com produces a product called *ADG Panorama Tools 4.0*:
http://www.albatrossdesign.com/products/panorama/

   Which, in their own words: " is a program, which lets you from a series of photos quickly and easily generate, edit & embed publish 360 degrees interactive panoramic composition on the web".

   The term "interactive" may refer to the ability of the user of the program to rotate through a 360 degree view that is pre-generated from a series of still photos.

   The program does not deal with live transmission of images, where the view constantly changes not only with respect to camera angle, but also with time.

2. Many web sites (e.g., museums) allow multiple visitors to each take an individual "virtual tour" of the location and/or manipulate exhibits.

   Viewers are simply seeing a pre-generated series of still images.

3. With computer games, the data available to a player may be dependent upon his current 'location' within the game.

4. In web sites, work on retrieval of a linked item, e.g., the next page, may begin before the user has selected the link for that page.

5. There are commercial software products, including Internet Explorer, which will download links onto a user PC.

6. US Patent 5,600,368 to Matthews: A plurality of cameras at an event allows a viewer to switch between discrete camera views. Keys on the remote unit are arranged in a pattern that corresponds to the various camera views available.

7. US Patent 4,062,045 to Iwane: Production of 3D images by means of a plurality of TV cameras.

8. US Patent 4,931,817 to Morioka: Improvement in a process for producing works of sculpture.

9. US Patent 5,448,291 to Wickline: A multiplicity of cameras, each of which produces a distinct image on a separate screen (e.g., screens placed above the stage in a theatre).

10. US Patent 5,659,323 to Taylor: Discusses effects that can be produced prior to broadcast by having an arrangement of a multiplicity of cameras.

11. US Patent 5,703,961 to Rogina et al: Synthesis of images from a multiplicity of cameras to allow a viewer to change the angle of view when he moves his head.

12. US Patent 6,359,647 B1 to Sengupta: Automation of a multiple-camera system based upon the location of a target object in a displayed camera image.

13. US Patent 6,373, 508 B1 to Moengen: Path of a (moving) object within a picture. The patent also discusses replacing, prior to, or during, the broadcast the display of a tracked object with another (e.g. more clearly visible) object.

14. US Patent 5,714,997 to Anderson: Virtual-reality TV system. allows a viewer to select viewpoints of a scene, and receive sounds as they would be heard at that point.

15. US Patent 5,729,471 to Jain et al: Display of discrete images based on requested view or selected object, instant replay based on event (e.g., player crossing touchline). Ability to select, and ask questions about, an object.

16. US Patent 5,745,126 to Jain et al: Divisional of 5,729,471.

17. US Patent 5,850,352 to Moezzi et al: Discusses "hypermosaicing" of multiple video perspectives on a scene; detecting and tracking objects, production of a 3D dynamic model – from which selectively synthesized 2D video images can be generated.

18. US Patent 6,144,375 to Jain et al: Content-based interactive video query system, e.g., home runs hit by a specific player, request to view via sensor next to the bookshelf. Only the video events of interest are transmitted over the transmission network. Also discusses motion detection. This is achieved, e.g., by providing an event timeline or allowing viewer interaction with a 2D video window. The material is recorded and maintained by an interactive multimedia system.

19. US Patent 6,154,251 to Taylor: Array of cameras, with the output of each recorded in advance and arranged to produce a virtual camera. Allows effects such as freeze of the actual motion within a scene while allowing the illusion of camera movement with respect to the frozen scene. A 'motion blur' could be employed to smooth the human-eye view of the transition from frame to frame.

20. US Patent 6,327,381 B1 to Rogina et al: Pixel data elements of a picture produced e.g., by several cameras on a spherical locus, and viewed e.g., from within a cave.

21. The ability to transmit one's location, and, in particular, to transmit via a cell phone details regarding ones location is not new. There is a cell phone that enables the user to transmit details of the user's location to the person receiving the call.

22. There is a camera that combines a picture and the location in which the photo was taken. US Patent 6,396,403 uses GPS and a camera to monitor a child.

23. Regular Caller ID used when receiving a phone call.

24. There is Internet software that allows people to know who else of their associates are on-line such as ICQ and Yahoo Messenger.

25. Webcams. Anyone able to access the site can view the picture provided by a webcam. Access to the display is not dependent on the location or presence of an individual in front of the camera.

26. Cell phones that can receive/transmit video.

27. Published PCT Patent Application WO 00/01149 of NDS Limited describes a digital television recording method including broadcasting a television program, operating an agent for determining whether to record the program, storing the program, and retrieving at least part of the program for display. Access to predetermined portions of the program may be determined by a user set of parameters. The program may be edited to include the user set of parameters, which then may be stored as part of the program. A commercially-available system based on the invention of PCT Patent Application WO 00/01149, known as "XTV", is commercially available from NDS Limited, One London Road, Staines, Middlesex, TW18 4EX, United Kingdom.

28. The widely-used MPEG-2 system is described, for example, in: a) ISO / IEC 13818-1; and b) Haskell et al, Digital video : An Introduction to MPEG-2; New York, Chapman & Hall, 1997.

29. The widely-used MPEG-4 system is described, for example, in ISO / IEC 14496.

The disclosures of all references mentioned above and throughout the present specification are hereby incorporated herein by reference.

3. SUMMARY OF THE INVENTION

In digital systems, each time a viewer changes a channel there is a noticeable delay while the request is processed.

Significant reduction in this delay could be useful in cases where a smooth transition between channels is desired.

If a system with more than one tuner and memory is able to anticipate the viewer's next channel-change request, dividing up the work involved in locating and processing channels between the tuners could achieve reduction in the delay in showing images from the new channel.

The terms "regular channel" and "virtual channel" are used as follows in the present specification and claims:

A regular channel is a channel that a viewer accesses by performing regular change-channel activities. A virtual channel is a channel that is associated with a regular channel, and is accessible via the regular channel.

For example, a viewer could press the appropriate change-channel buttons on his remote control to access a regular channel that displays a baseball game. Associated with the regular channel may be virtual channels (e.g., each with a different camera view of the game) that are accessible once the viewer is viewing the regular channel.

A regular channel may have a number of virtual channels associated with it. A regular channel may solely comprise a number of virtual channels.

There is thus provided in accordance with a preferred embodiment of the present invention an anticipatory tuning system including a plurality of tuners including at least a first tuner and a second tuner, and a tuner controller controlling the first tuner and the second tuner, wherein the tuner controller instructs the first tuner to tune to a first channel, and the tuner controller instructs the second tuner to tune to a second channel based, at least in part, on anticipation of likely future user input.

Further in accordance with a preferred embodiment of the present invention the tuner controller instructs the first tuner to tune to a first channel based, at least in part, on user input.

Still further in accordance with a preferred embodiment of the present invention the tuner controller instructs the second tuner to tune to the second channel based, at least in part, on an external input.

Additionally in accordance with a preferred embodiment of the present invention the external input includes an input from a broadcast source or a headend.

Moreover in accordance with a preferred embodiment of the present invention the system further includes a display unit operative to display audio and / or video content.

Further in accordance with a preferred embodiment of the present invention the system also includes a content storage unit operative to store the audio and / or video content.

Still further in accordance with a preferred embodiment of the present invention the content storage unit is operatively associated with the tuner controller.

Additionally in accordance with a preferred embodiment of the present invention the tuner controller instructs at least one of the plurality of tuners to output the stored audio / video content operatively associated with the at least one of the plurality of tuners to the content storage unit for storage therein.

Moreover in accordance with a preferred embodiment of the present invention the tuner controller retrieves the audio / video content stored on the content storage unit for display on the display unit.

Further in accordance with a preferred embodiment of the present invention audio / video content output by the first tuner is displayed on the display unit and audio / video content output by the second tuner is not displayed on the display unit.

Still further in accordance with a preferred embodiment of the present invention audio / video content output by the second tuner is stored on the content storage unit.

Additionally in accordance with a preferred embodiment of the present invention the audio and / or video content includes an encoded data stream.

Moreover in accordance with a preferred embodiment of the present invention each of the plurality of tuners includes a decoder for decoding an encoded data stream.

Further in accordance with a preferred embodiment of the present invention the encoded data stream is an encoded video stream.

Further in accordance with a preferred embodiment of the present invention the encoded video stream includes an MPEG data stream.

Still further in accordance with a preferred embodiment of the present invention the MPEG data stream includes an MPEG-2 data stream.

Additionally in accordance with a preferred embodiment of the present invention the MPEG data stream includes an MPEG-4 data stream.

Moreover in accordance with a preferred embodiment of the present invention the anticipation of likely future user input is at least partially determined by previous user input.

Further in accordance with a preferred embodiment of the present invention the previous user input includes previous user channel changes.

Still further in accordance with a preferred embodiment of the present invention the previous user channel changes were in a first direction, and the anticipation of likely future user input is in the first direction.

Additionally in accordance with a preferred embodiment of the present invention the first direction is either an upwards direction or a downwards direction.

Moreover in accordance with a preferred embodiment of the present invention the previous user channel changes include changes between virtual channels.

Further in accordance with a preferred embodiment of the present invention at least one favorite channel is determined based, at least in part, on the previous user input.

Still further in accordance with a preferred embodiment of the present invention user input tracks a discrete object.

Additionally in accordance with a preferred embodiment of the present invention the discrete object includes a person.

Moreover in accordance with a preferred embodiment of the present invention the person includes an actor.

Further in accordance with a preferred embodiment of the present invention the person includes a player.

Still further in accordance with a preferred embodiment of the present invention the person includes an audience member.

Additionally in accordance with a preferred embodiment of the present invention the person cannot be tracked without the person's knowledge and / or permission.

Moreover in accordance with a preferred embodiment of the present invention the person signals permission to be tracked to the broadcast source or to the headend.

Further in accordance with a preferred embodiment of the present invention the person sends an authorization list of parties with permission to track the person to the broadcast source or to the headend.

Still further in accordance with a preferred embodiment of the present invention the person signals permission to be tracked directly to the anticipatory tuning system.

Additionally in accordance with a preferred embodiment of the present invention the system also includes a plurality of cameras operative to provide a panoramic view of the object of interest wherein each camera of the plurality of cameras provides a viewing range which is a subset of the panoramic view.

Moreover in accordance with a preferred embodiment of the present invention the panoramic view includes an approximately 360 degree view.

Further in accordance with a preferred embodiment of the present invention the first tuner and the second tuner include a single interleave-enabled tuner.

Still further in accordance with a preferred embodiment of the present invention the tuner controller includes a special-effects generator for locally producing special effects.

Additionally in accordance with a preferred embodiment of the present invention the system also includes a cellular telephone, and the plurality of tuners and the tuner controller are included in the cellular telephone.

There is also provided in accordance with another preferred embodiment of the present invention display apparatus for marking an object of interest on a television display, the apparatus including an object determiner determining an object of interest based, at least in part, on user input, a position information receiver receiving, from a source remote to the display apparatus, information defining a position of the object of interest within a displayed picture, and

a displayer displaying a visible indicator at a display position on the display, the display position being based, at least in part, on the position of the object of interest.

Further in accordance with a preferred embodiment of the present invention the information is sent from a broadcast source or headend.

Still further in accordance with a preferred embodiment of the present invention the information is addressed to at least one particular viewer.

Additionally in accordance with a preferred embodiment of the present invention the information is sent via a phone message directly to at least one STB associated with the at least one particular viewer who is authorized to view the object of interest.

Moreover in accordance with a preferred embodiment of the present invention the object of interest is operatively associated with an ID.

Further in accordance with a preferred embodiment of the present invention the object of interest includes a person.

Still further in accordance with a preferred embodiment of the present invention the person includes an actor.

Additionally in accordance with a preferred embodiment of the present invention the person includes a player.

Moreover in accordance with a preferred embodiment of the present invention the person includes an audience member.

Further in accordance with a preferred embodiment of the present invention the person cannot be tracked without the person's knowledge and / or permission.

Still further in accordance with a preferred embodiment of the present invention the person signals permission to be tracked to the broadcast source or to the headend.

Additionally in accordance with a preferred embodiment of the present invention the person sends an authorization list of parties with permission to track the person to the broadcast source or to the headend.

Moreover in accordance with a preferred embodiment of the present invention the person signals permission to be tracked directly to the anticipatory tuning system.

4. DESCRIPTION OF PREFERRED EMBODIMENTS

4.1. GENERAL

Given a system that receives broadcasts and has more than one tuner and sufficient memory:

If the system is able to anticipate the viewer's possible next channel-change requests then while the images accessed via one tuner are being displayed, another tuner can begin processing in the images of the anticipated next channel.

Conventional technology does not deal with the digital-TV channel-switching delay issue or require that processing be performed prior to the broadcast to achieve the desired effects, and therefore do not provide viewers with the same degree of control.

The rest of this section discusses examples of anticipatory tuning. The examples are not meant to be all-inclusive. The examples shown are merely intended to illustrate the concept of using additional tuners to deal with the delay in channel switching.

4.2. EXAMPLE: VIEWER CONTROL OVER CAMERA MOVEMENT

4.2.1. General

To simulate the images transmitted by movement of a single camera, cameras may be placed at strategic locations apart from each other such that the possible paths the viewer can take from each camera being viewed to the next are predetermined.

Methods for determination of the distance between each camera could include simple measurement, GPS, sound waves, lasers, adjustment based on trial observation of results, or any other known method.

For example, given a series of cameras placed equidistantly from each other around a sports arena each facing the sports field, as in the following diagram:

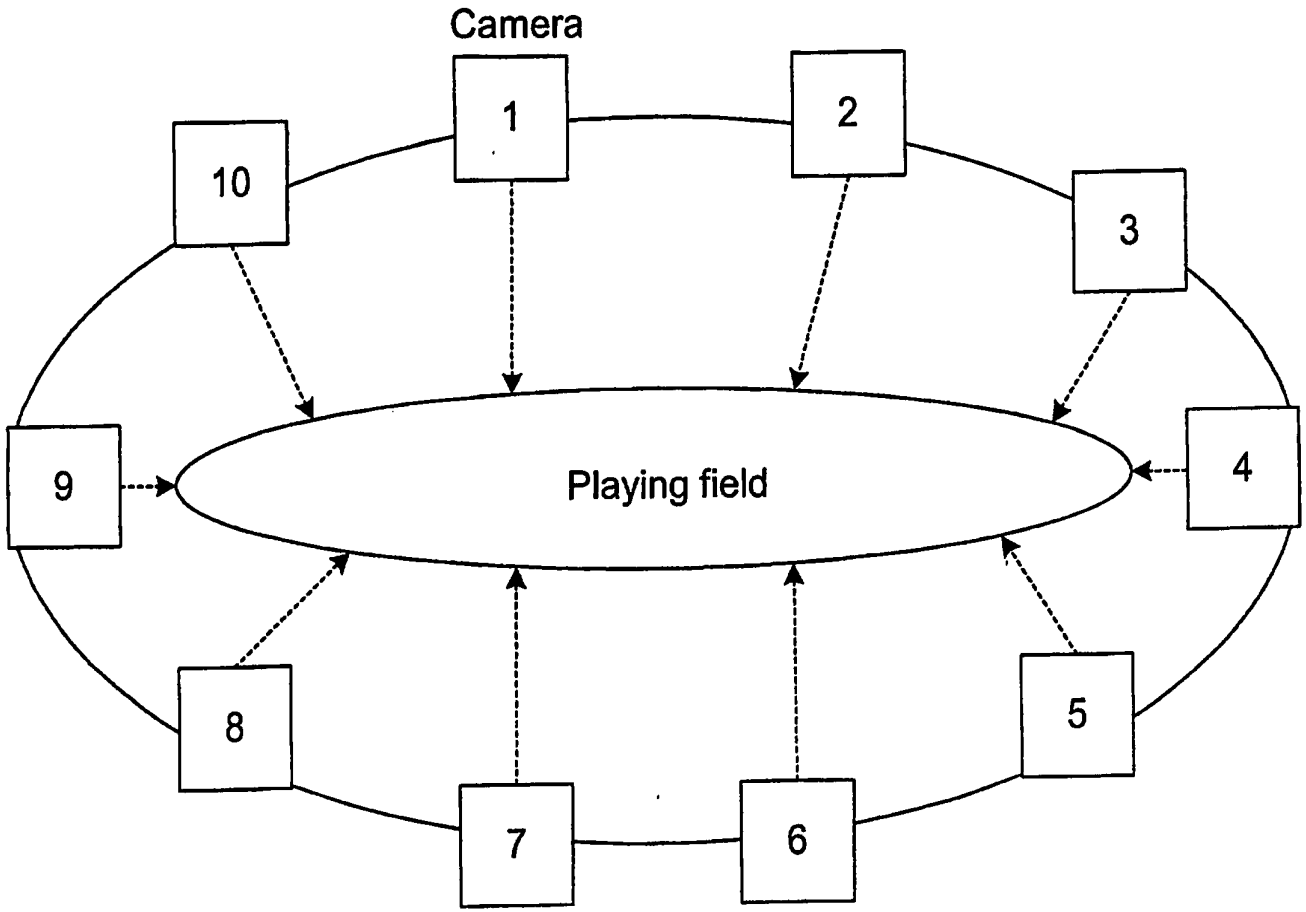


Figure 1: **Example Camera Arrangement for Viewer Control of Camera Movement**

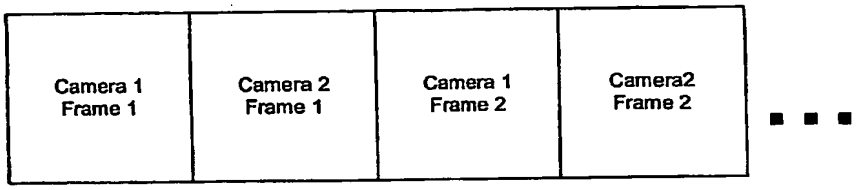
The proposal takes advantage of the fact that a viewer's possible paths are known in advance. For example, a viewer watching a game via camera 8 has the option of moving (e.g., via right, left arrow keys on the remote control) to camera 7 or camera 9.

Therefore, in our example, a system that has sufficient memory storage and tuners (e.g., XTV) could begin processing and storing the images received from **at least** camera 7 and camera 9 (and possibly also camera 6 and camera 10) while the image from camera 8 is being displayed.

The greater the processing power, memory, and number of tuners of the receiving device, the further ahead the device can "plan", i.e., the more camera images it can process in advance based on the possible paths the viewer can take.

Alternatively, or additionally, given sufficient processing power and memory, background processing of images from the next path could be interleaved on a single second tuner. That is, while the first tuner is responsible for accessing the images that are currently being displayed, a secondary tuner could be doing the preparatory work on a number of tuning locations, i.e., skipping between different tuning locations and processing, and possibly storing information obtained.

Alternatively, or additionally, the output from more than one camera could be broadcast on a single channel at a faster than usual rate of transmission, with the frames interleaved. For example:



When accessing a frame, a tuner could read a "camera ID" included with the frame (e.g., in private tables) to establish whether to process the frame (if it is related to the current camera view) or skip it (if it is not related).

Such interleaving could be achieved using digital multiplexing of distinct video streams, as is well known in the art; see, for example, the MPEG-2 references mentioned above.

Cameras could also be arranged to allow other effects, such as the illusion of "zoom".

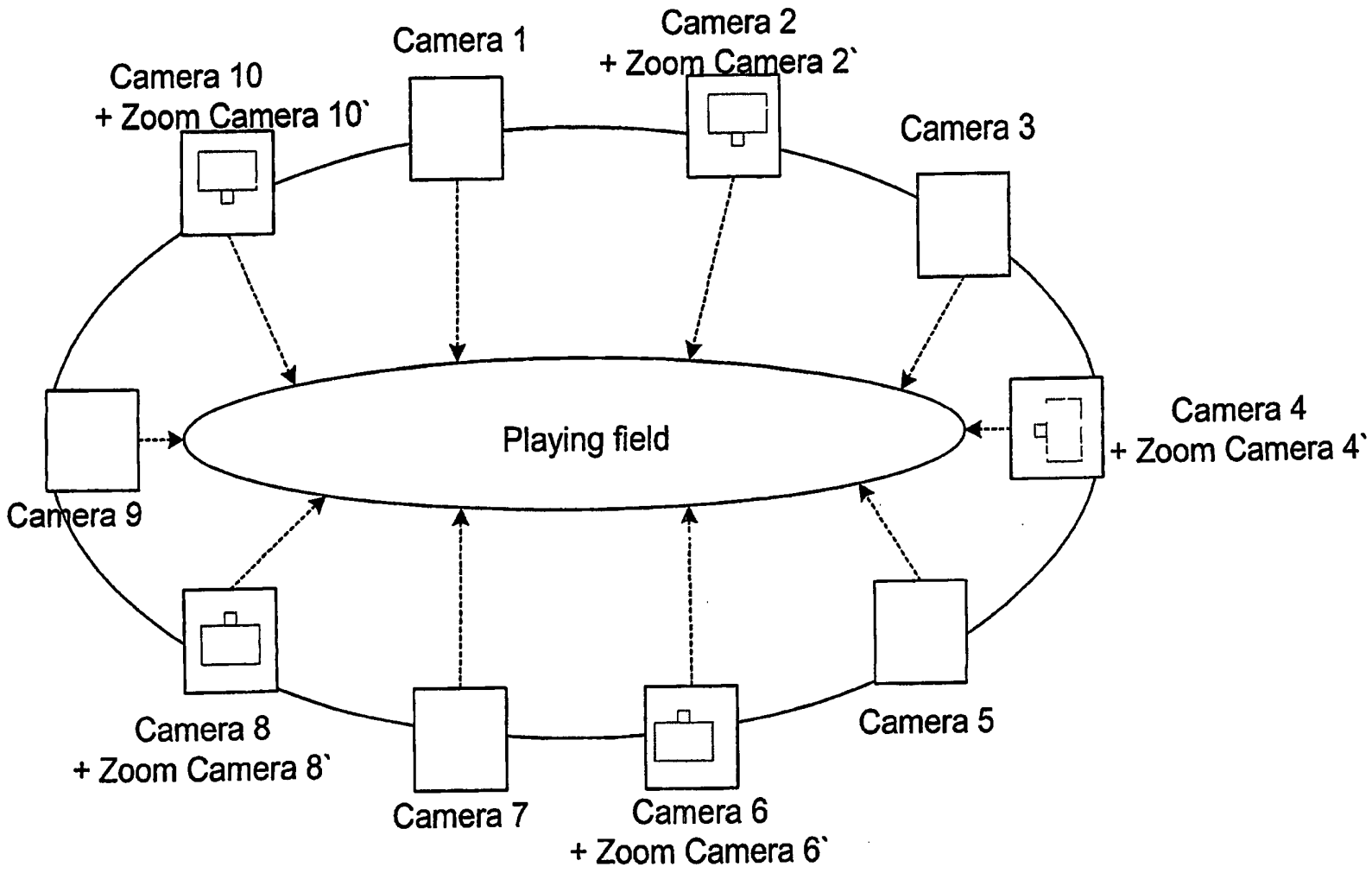


Figure 2: **Example of Arrangement of Cameras to Enable Viewer Control of Zoom**

That is, in our example, while viewing via camera 8, the viewer would have the option of zooming (e.g., by pressing a toggle zoom/unzoom button between the two arrow keys) to select camera 8` which is a zoom of the same view as camera 8. Camera 8' is preferably set up to show an equivalent view to camera 8, but zoomed.

When viewing from camera 8` the alternative paths would be cameras 8, 6`, or 10`

Therefore, when viewing the output from camera 8, the possible paths the viewer can take are camera 7, camera 9 or camera 8`.

Alternatively or additionally, there could be an additional outer ring of cameras, with their relationship with the other cameras defined in the same manner – this would enable the viewer to "zoom out" (e.g., by pressing a button that had three degrees of zoom: "zoom out", regular view, "zoom in").

To allow a scan of the total area covered by cameras that is not temporally disjointed there has to be synchronization between the output of each camera.

Special effects could also be created, by deliberately having cameras with different speeds (rates at which images are transmitted), focuses, etc (see **Section 4.2.4. Data Associated with Images** below).

In addition, at least some of the cameras could be mobile:

If camera 7 in our example was mobile and its path of motion oscillated between camera 6 and camera 8; camera 7 could serve as an intermediate stage between camera 6 and camera 8 and thereby make the transition smoother. The IRD would need to know when to transfer the display between a fixed and mobile camera (see **Section 4.2.4. Data Associated with Images** below)

It is appreciated that metadata signaling the points in time at which a smooth transition is possible can be generated in the headend and delivered to the STB (set top box). The terms STB (set top box) and IRD (integrated receiver-decoder) are used interchangeably throughout the present specification and claims.

The different possible paths from a specific camera view can be assigned levels of priority. In the sports field example, while the viewer is viewing via camera 8 the possible next views could be from camera 7 or camera 9. However, if the viewer is pressing the arrow key that

causes clockwise scanning, the most likely path is to camera 9. This camera view can be given processing priority, i.e., a slightly longer delay may be acceptable if the viewer suddenly changes direction.

4.2.2. Relationship with Regular Discrete Views (e.g., Picture in Picture)

Combined with the continuous moving-camera view, regular discrete views could also be available while scanning the sports field.

One option is for the discrete views displayed at any instant to depend on the particular location currently being scanned via the associated cameras.

For example, scanning a sports field could cause a tickertape effect of selectable thumbnail discrete images to move across the bottom of the screen.

4.2.3. Independent Special effects in Response to Viewer Camera Control Requests

The system can produce certain independent special effects. For example:

- When zooming, suitable camera-adjustment sound effects could be produced.
- If the viewer suddenly changes the scan direction, the system could cause the picture to wobble slightly before changing direction, as through the camera was overcoming resistance to the sudden change in its direction of motion. The "wobble" would give another tuner time to complete its background processing of the image from the anticipated next camera.

4.2.4. Data Associated with Images

Data associated with the corresponding cameras could be sent together with the broadcast of the images, or as part of data sent prior to the broadcast and stored for use during the broadcast; alternatively, this data could be sent after the broadcast, with the broadcast material being stored for use with the data. Additionally or alternatively, the data could be sent via a different medium than the medium used to broadcast the images.

1) The IRD needs to receive the possible paths the viewer can take from each camera view. This information (e.g., in the form of tables) can be sent for all of the associated cameras, or for each camera individually.

2) For continuity purposes, the output and transmission of images should be synchronized. Alternatively or additionally, a time stamp could be sent with each image from each associated camera, to allow the IRD to decide when switching cameras, which of the images received from the next camera to display.

3) Data relating to special effects: Images from the associated cameras need not be displayed in fixed chronological order.

   For example, in our example, scanning the field in a clockwise direction could cause the images to be displayed in forward chronological order, and scanning the field in an anti-clockwise direction could cause the images to be displayed in reverse chronological order. This could be achieved by storing images from cameras obtained by the tuners.

   Other effects could include, for example, different camera rates, alternating between regular view and zoom as the viewer scans the sports field, etc.

   Data could be sent informing the IRD how to produce the necessary effects (e.g., rates of image production per camera, instructions to take an image with an earlier timestamp if scanning via left arrow key, instructions to alternate between regular view and zoom when switching between cameras, sound effects when switching to specific camera, e.g., zoom sound effect or simply sending a type of view so that the IRD can access its own store of sound effects etc)

4) In addition to the main picture formed by the multiple cameras, if discrete regular views are also being displayed e.g., in pictures within the main picture, then if the discrete views available at any

instant depend on which associated camera's image is currently being displayed on the main picture, this information could be sent to the IRD.

5) If the distance between cameras varies, e.g., if one or more of the cameras are mobile, the delta of the distance between them (e.g., the difference in positional values from the two cameras) and the direction of travel of the mobile camera(s) (e.g., towards each other/away from each other) could be sent to the IRD (or the IRD could work out the direction of travel by comparing chronological delta values received). The IRD could be instructed (in real time or in advance) as to the range of delta values and direction of travel of the two cameras relative to each other in which the IRD can transfer display. Display can be transferred between any cameras; the 'direction' will be the positions of the cameras relative to each other. In this specific example, the direction is the direction of travel of the two cameras relative to each other. Alternatively the headend could send data informing the IRD when the mobile camera is available as a transition from a specific other camera.

Examples of methods for computing differences in positional values between two cameras include any device or method for measuring the distance between two objects and keeping track of how those values change with time. For example, there are ultrasound, infrared, etc. devices as is well known in the art, employed in vehicles to enable a driver to know when he is too close to a wall when traveling backwards. This could be adapted to have two cameras exchange signals to measure the distance between them. There are also GPS systems; mostly military – though accurate commercial systems are becoming available – that have a high degree of accuracy. Comparisons could be made between the results from such systems for each camera.

6) Conditional access, as is well known in the art, could be applied to broadcast data such as video data; the data could be encrypted, and the viewer may require authorization to manipulate the camera views.

4.2.5. Variations on the Theme

There could be any patterns of arrangements of cameras: Another example of associating a group of cameras could be a wall of cameras each focused on a section of a stage during e.g., a live theatre production. Each viewer would be able to individually change the view

of the stage, zoom in on a particular actor, etc, in a simulation of actually being in the audience.

4.3. EXAMPLE: VIEWER TRACKING OF PEOPLE, OBJECTS DURING LIVE TRANSMISSION

4.3.1. General

The views broadcast by a plurality of cameras as in the above example may also contain elements that are of individual interest to specific viewers.

For example, individual viewers may be interested in tracking a particular player in a football game, or watching a specific actress in a theatre production.

Methods for tracking an individual object as it moves within the area scanned by various cameras, and changing the camera view that is displayed in accordance with the object's movements are known in the art.

However, the prior art does not deal with the digital-TV channel-switching delay issue. For example, a security guard watching a closed-circuit network may tolerate a delay between switching cameras which would not be acceptable in an entertainment environment. The prior art requires that processing be performed prior to the broadcast to achieve the desired effects. In prior art systems, the viewers are provided with a broadcaster-controllable number of tracked objects that are each broadcast separately, and therefore do not provide viewers with the same degree of control.

By being able to send the same camera views to everyone, and allow each individual viewer to track whoever she wishes as though each viewer were operating a single camera, the broadcaster could save significant bandwidth over the unviable scenario of providing every user with their own remote camera to operate.

Additionally, some preferred embodiments of the present invention could enable someone watching a game to locate his or her friends or family in the crowd (with the acquiesce of the persons being viewed).

In other systems a broadcaster would not be able to accede to individual requests from the entire TV. audience to view specific people. The broadcaster could not possibly assign cameras, staff, or

bandwidth to help individual viewers locate individual members of the audience.

It is appreciated that MPEG-2 supports a method for allowing an STB to crop and scale the video image, that is to select a portion of the image and display it full-screen. This feature could be utilized for this application by broadcasting a limited number of very high-quality large-scale video sequences, and additional metadata describing which crop and scale factors to apply to the image in order to focus on particular players, parts of the stands, etc. This saves considerably on video bandwidth, while still allowing highly personalized focus.

4.3.2. Transmitting and Translating Location Values

At an event with a plurality of cameras, each frame or group of frames that is sent by each camera could have associated with it a range of location values (e.g., GPS values). These location values could be, for example, coordinates encompassing the length breadth and depth covered by each camera. These coordinates could be a factor of the focus of the camera.

A tracking device can be associated with each player in a game.

For each player, the tracking information obtained at each instant could be sent to the headend.

The headend could compare each player's tracking information with the location coordinates produced by frames of appropriate cameras at the same instant.

The headend could thus translate the tracking information for each player into a series of ID numbers of the cameras producing frames in which the player appears. (For simplicity, these ID numbers will also be called camera IDs.)

The headend could send these ID numbers of the cameras to IRDs together with information about which player they refer to, or location details of each player and the IDs of cameras that are currently scanning the player's current location.

Alternatively, or in addition, each player's individual tracking information could be sent to IRDs together with the coordinates covered by each camera.

The IRD could thus compare the tracking information for a specific player in order to decide which camera view to show if the viewer

requests to track that specific player (see the 'Selecting the "Best View"' section).

In a similar manner, someone in the crowd at the event could also transmit his location to specific IRDs:

Transmission by someone in the crowd of his location could be accomplished by making a phone call (or device call) to the headend and sending via the device location information, personal ID information, and information identifying the IRD to be contacted. The headend could produce the required information, as described above and then address it to the appropriate IRDs (over-the air, telephone, internet, etc).

Alternatively, the person in the crowd could phone the specific IRDs with relevant location information and personal ID information. The IRDs could then either send the received information to the headend (e.g., via callback) and the headend could send back the required camera ID and associated information, or the IRDs could each receive the location coordinates together with the frames from the individual cameras and then process the information received directly from the person in the crowd to obtain the appropriate camera IDs.

It is possible that someone wishing to transmit to IRDs would have to provide a means of proving authorization, such as a password/PIN. Alternatively, if the caller provides an IRD ID this may be deemed sufficient if the number of the device making the call is associated (paired) in advance with that IRD.

4.3.3. Selecting the "Best" View

The headend could send either all the camera IDs of the cameras which produce frames in which a player appears, or could select the "best" according to defined criteria. The "best" camera IDs could, for example, be those where the player is closest to the camera, or closest to the center of the frame, etc

Alternatively or additionally, each IRD could select from the camera IDs received the best views for that IRD. For example, the IRD could select the camera ID that is closest to the camera the viewer is currently viewing. This could be especially useful in the type of setup described previously:

Given a series of cameras placed equidistantly from each other around a sports arena each facing the sports field, as in Figure 1.

If camera 2 and camera 5 both provide good views of a specific player, and the viewer is currently viewing the game via camera 3, then the IRD could select a frame associated with the camera ID from camera 2 as the view to offer the subscriber because camera 2 is in closer proximity to camera 3 than camera 5.

Another example of selecting the "best" camera view:

Here cameras are arranged in Figure 2 such that a viewer can zoom in on a scene by selecting a "zoom" camera placed in the same vicinity as the regular camera.

If the best view of a specific player is via "zoom camera" 2, the viewer may be offered regular camera 2. If the viewer then wants to take a closer look, he can then select zoom camera 2. The system may be configured to give the viewer the best regular view, and then allow the viewer the option of deciding whether or not to zoom in. Alternatively the system may be configured to give the user the corresponding zoomed in view when that is the best view available.

As an alternative to the headend processing location information from the cameras and tracking devices, this information could be sent unprocessed to IRDs, where it could be translated into the appropriate camera views.

4.3.4 Subscriber Selection of Views

A viewer could select the camera views that display a specific player or member of the crowd or request that camera views change automatically in order to track that person.

Associated with the data provided about each player in a game, or as part of a separate list, there could be a "Track" option that the subscriber could activate/deactivate.

The IRD could then automatically show the best view from then on (i.e., switch camera views automatically based on the selected players' movements) and/or mark those available views from which the player could be seen (for example, next to a thumbnail view in which a selected player can be seen could be an identifier such as the name of the player or a flashing dot).

In addition, or as an alternative to having the subscriber select a Track option; associated with distinct views from each available camera (e.g., via picture-in-picture) could be a list of players that could be viewed via that camera.

If a person in the crowd sends his tracking information to an IRD (as described above) the identity of the sender needs to be established before the tracking alternatives described for a player are implemented to track that person in the crowd:

The calling device could be associated with the IRD, or the subscriber could have a predefined list of people that can call the subscriber's IRD or the phone number of the caller could be used as the "name" of the person for tracking purposes (this is similar to Caller ID in a regular phone system).

In addition to showing the view in which a specific person appears, the IRD could superimpose over the view a frame, e.g., a circle, around the actual area where the person appears. This could be sent as a transparent on screen display (OSD) to that area of the display. This could be especially useful where the user has the option of selecting a zoom option as described above. Note that this may also be possible in a non-multi camera environment.

Given the position (or approximate area) of the required object on the screen, as explained above, and the coordinates covered by the specific camera view, the IRD could position an OSD appropriately to surround that area.

In a preferred embodiment of the present invention, using the crop/scale functions mentioned above, the headend can keep the object of interest in a reasonably fixed position. This allows the OSD position to be predefined and then the headend is responsible for generating the crop/scale factors accordingly

4.3.5. Smooth Switching of Cameras

In a digital TV system, motion detection as known in the art can be used for anticipating not only the camera which is currently displaying the person being tracked but could also anticipate into which camera view the person being tracked will enter next.

Anticipatory tuning can be employed as previously described.

If there are limited resources (e.g., tuners and memory), priorities can be assigned. For example, if the person is running; the camera into whose view he is expected to next run may be given priority over a zoom on the scene or over cameras into which he would run if he suddenly switched direction. If he suddenly switched direction, a delay during which the camera "wobbled" as though changing its direction of

motion (and another tuner background processed the image from the camera selected) may be acceptable.

4.3.6. Variations on the Theme

4.3.6.1. Message to Non-Specified IRDs

A person in a crowd could send a message to a headend that is not directed at specific IRDs. Subscribers would be able to send a list of their family/friends to the headend. Wherever the lists match, i.e., a member of the crowd asks to let his friends know he's at the game, and his friends request to see him, the information would be sent to the appropriate IRD(s).

4.3.6.2. Phone Calls from Tourist Sites

A person could make use of cameras in public places, e.g., in malls or tourist sites, to send a picture of himself and his surroundings to the TV set of someone while making a call (this, of course, would require cooperation of various parties).

Someone making a phone call could provide the recipient with a much better view of the area than could be provided by a small camera included within a cell phone.

Cameras in public places could be used to broadcast to TVs.

Furthermore, as explained above, a number of cameras in a single place could be combined to give a viewer at home the impression that he is manipulating a single camera or that a single camera is tracking the person with whom he is speaking.

One option would be for viewers to only be able to view one of these channels if they are actually speaking to someone at that location. This would address privacy concerns.

Someone at a public place would be enabled to send a view of himself from a camera in the public place to a viewer with panoramic viewing at home. However the viewer would not be able to focus in on strangers in a public place without their permission.

This would require that the headend, once it has matched up a specific caller with specific IRDs as described above, provide the specific IRD with permission to view that channel. This could consist of information

or permission required to produce control words to unscramble encrypted broadcast material or to tune to the channel.

Additionally, or alternatively, a direct link could preferably be made between a phone and an IRD before the IRD will display the channel. This could be enforced by the IRD or by a device associated with the IRD, e.g., a smart card that would not produce a control word if it did not receive information from (one of) the telephone(s) associated with that channel.

4.3.6.3. Anticipatory Tuning by Cell phone

If a cellular phone (or similar device) is able to receive and transmit video then:

Instead of someone with a cellular phone arranging via the headend for IRDs to receive video together with his call as described above, cameras could send video to the cellular phone. This video could in turn be transmitted by the cellular phone as part of a call to a receiving device.

If the cellular phone could receive/transmit broadcasts and had multiple tuners, it could receive broadcasts from public cameras, including video and location data as explained previously, and use anticipatory tuning based on the owner's direction of travel to switch between camera outputs to send to a receiving device.

4.4. EXAMPLE: VIEWER ZAPPING PATTERNS

Use of more than one tuner and sufficient memory could also be used to reduce zapping time during regular digital channel surfing. For example if a viewer zapped from channel 5 to channel 10, the system could start background processing of images, audio, and data associated with the 'next button' channel (channel 11), the 'previous button' channel (channel 9) and the 'toggle channel' button (channel 5).

Depending on the viewer's zapping behavior, priorities for anticipating the viewer's next choice could be established. For example, after the viewer has pressed the "next button" channel a few times in succession, the system may give greater priority to processing the next channel than to processing the previous channel.

4.5. MISCELLANEOUS

The examples sited above are not all-inclusive. They are intended merely to illustrate the concept of anticipatory tuning.

For example:

As explained above, anticipatory tuning can allow smoother transitions between channels, thereby allowing a greater degree of flexibility than could be achieved by simply preprocessing the information obtained from a number of cameras, and then broadcasting the result in a single channel whose contents cannot be manipulated by the viewer.

However, there are times that it may be convenient to combine the features provided by preprocessing material from a number of cameras with anticipatory tuning.

For example, the production of a 3D image by combining the output from a number of cameras each of which film the same scene from a slightly different angle is known in the art.

A number of channels, each of which contains a 3D image of the same scene but from a different angle could be sent. Anticipatory tuning could then be used to allow a viewer to view the same 3D scene from various angles.

This can be illustrated by Figure 3:

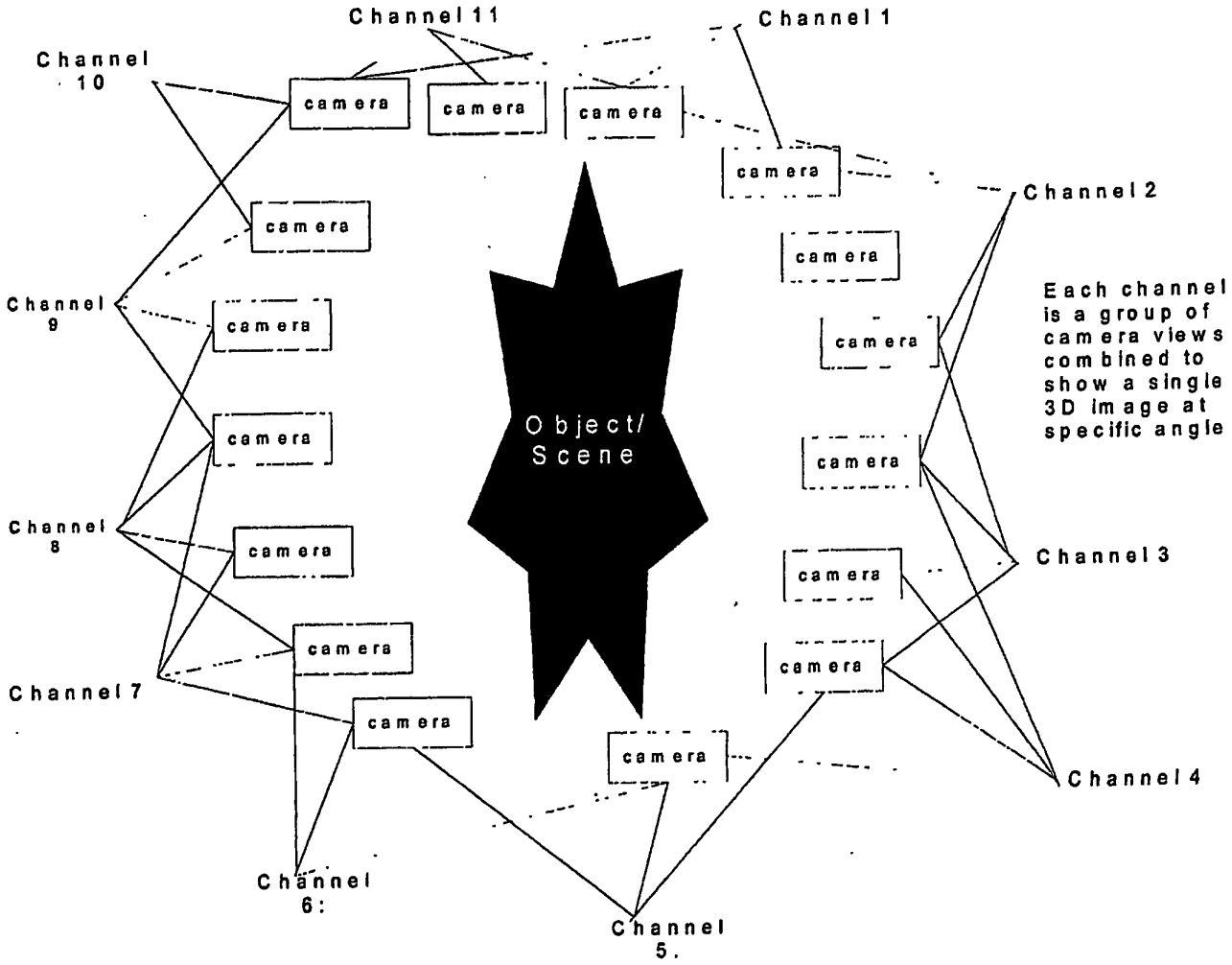


Figure 3: **Example of Arrangement of Cameras to Enable Viewer Control of Rotation of 3D Image**

CLAIMS

1. An anticipatory tuning system comprising:

a plurality of tuners comprising at least a first tuner and a second tuner; and

a tuner controller controlling the first tuner and the second tuner,

wherein the tuner controller instructs the first tuner to tune to a first channel, and

the tuner controller instructs the second tuner to tune to a second channel based, at least in part, on anticipation of likely future user input.

2. The system according to claim 1 and wherein the tuner controller instructs the first tuner to tune to a first channel based, at least in part, on user input.

3. The system according to claim 1 or claim 2 and wherein the tuner controller instructs the second tuner to tune to the second channel based, at least in part, on an external input.

4. The system according to claim 3 and wherein the external input comprises an input from a broadcast source or a headend.

5. The system according to any of the above claims and further comprising a display unit operative to display audio and / or video content.

6. The system according to claim 5 and further comprising:

a content storage unit operative to store the audio and / or video content.

7. The system according to claim 6 and wherein the content storage unit is operatively associated with the tuner controller.

8. The system according to claim 7 and wherein the tuner controller instructs at least one of the plurality of tuners to output the stored audio / video content operatively associated with the at least one of the plurality of tuners to the content storage unit for storage therein.

9. The system according to claim 7 wherein the tuner controller retrieves the audio / video content stored on the content storage unit for display on the display unit.

10. The system according to claim 5 and wherein audio / video content output by the first tuner is displayed on the display unit and audio / video content output by the second tuner is not displayed on the display unit.

11. The system according to claim 10 and wherein audio / video content output by the second tuner is stored on the content storage unit.

12. The system according to claim 5, and wherein the audio and / or video content comprises an encoded data stream.

13. The system according to claim 10 and wherein each of the plurality of tuners comprises a decoder for decoding an encoded data stream.

14. The system according to claim 13 and wherein the encoded data stream is an encoded video stream.

15. The system according to claim 14 and wherein the encoded video stream comprises an MPEG data stream.

16. The system according to claim 15 and wherein the MPEG data stream comprises an MPEG-2 data stream.

17. The system according to claim 15 and wherein the MPEG data stream comprises an MPEG-4 data stream.

18. The system according to claim 13 and wherein the anticipation of likely future user input is at least partially determined by previous user input.

19. The system according to claim 18 and wherein the previous user input comprises previous user channel changes.

20. The system according to claim 19 and wherein the previous user channel changes were in a first direction, and the anticipation of likely future user input is in the first direction.

21. The system according to claim 20 and wherein the first direction is either an upwards direction or a downwards direction.

22. The system according to claim 20 or claim 21 and wherein the previous user channel changes comprise changes between virtual channels.

23. The system according to claim 19 and wherein at least one favorite channel is determined based, at least in part, on the previous user input.

24. The system according to claim 23 and wherein user input tracks a discrete object.

25. The system according to claim 24 and wherein the discrete object comprises a person.

26. The system according to claim 25 and wherein the person comprises an actor.

27. The system according to claim 25 and wherein the person comprises a player.

28. The system according to claim 25 and wherein the person comprises an audience member.

29. The system according to claim 25 and wherein the person cannot be tracked without the person's knowledge and / or permission.

30. The system according to any of claims 25 - 29 and wherein the person signals permission to be tracked to the broadcast source or to the headend.

31. The system according to claim 30 and wherein the person sends an authorization list of parties with permission to track the person to the broadcast source or to the headend.

32. The system according to any of claims 25 - 29 and wherein the person signals permission to be tracked directly to the anticipatory tuning system.

33. The system according to claim 23 and further comprising:

a plurality of cameras operative to provide a panoramic view of the object of interest wherein each camera of the plurality of cameras provides a viewing range which is a subset of the panoramic view.

34. The system according to claim 33 and wherein the panoramic view comprises an approximately 360 degree view.

35. The system according to any of the above claims and wherein the first tuner and the second tuner comprise a single interleave-enabled tuner.

36. The system according to any of the above claims and wherein the tuner controller comprises a special-effects generator for locally producing special effects.

37. The system according to any of the above claims and also comprising a cellular telephone,

wherein the plurality of tuners and the tuner controller are comprised in the cellular telephone.

38. Display apparatus for marking an object of interest on a television display, the apparatus comprising:

an object determiner determining an object of interest based, at least in part, on user input;

a position information receiver receiving, from a source remote to the display apparatus, information defining a position of the object of interest within a displayed picture; and

a displayer displaying a visible indicator at a display position on the display, the display position being based, at least in part, on the position of the object of interest.

39. Apparatus according to claim 38 and wherein the information is sent from a broadcast source or headend.

40. Apparatus according to claim 38 and wherein the information is addressed to at least one particular viewer.

41. Apparatus according to claim 38 and wherein the information is sent via a phone message directly to at least one STB associated with the at least one particular viewer who is authorized to view the object of interest.

42. Apparatus according to claim 38 and wherein the object of interest is operatively associated with an ID.

43. Apparatus according to claim 42 and wherein the object of interest comprises a person.

44. Apparatus according to claim 43 and wherein the person comprises an actor.

45. Apparatus according to claim 43 and wherein the person comprises a player.

46. Apparatus according to claim 43 and wherein the person comprises an audience member.

47. Apparatus according to claim 43 and wherein the person cannot be tracked without the person's knowledge and / or permission.

48. Apparatus according to claim 47 and wherein the person signals permission to be tracked to the broadcast source or to the headend.

49. Apparatus according to claim 47 and wherein the person sends an authorization list of parties with permission to track the person to the broadcast source or to the headend.

50. Apparatus according to claim 47 and wherein the person signals permission to be tracked directly to the anticipatory tuning system.